



**2804 Central Concepts**

**January 2005**

**Mark Scheme**

## ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.  
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

**x** = incorrect response (errors may also be underlined)  
**^** = omission mark  
**bod** = benefit of the doubt (where professional judgement has been used)  
**ecf** = error carried forward (in consequential marking)  
**con** = contradiction (in cases where candidates contradict themselves in the same response)  
**sf** = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Examiners will be expected to use their professional judgment in marking answers that contain more than the number required. Advice about specific cases will be given at the standardisation meeting.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
1 (a)	<p>produced in minute amounts ;      secreted into, blood / ductless gland ; <b>R</b> excrete      transported in blood ;      to target tissue (bone marrow) ; <b>A</b> specific receptors / another part of body      broken down in liver ;      many / some, hormones are proteins ; <b>R</b> all hormones are proteins</p>	<b>max 3</b>
(b)	<p><i>one mark for each example and two marks for associated role</i>  <i>max 3 for each PGR</i></p> <p>abscisic acid / ABA ;      closure of stomata / stress hormone ;      inhibiting proton pump ;      prevent excessive water loss / related to dry conditions / reduce transpiration ;  <i>or</i>      abscission of, leaves / fruits ;      details of abscission layer ;      (leaves are lost) in autumn / seeds dispersed ;  <i>or</i>      promotes seed dormancy / inhibits germination ;      prevents production of enzymes ;</p> <p>auxin / IAA ;  <u>apical dominance</u> ;      inhibition of lateral buds ;      shoots grow tall / AW ;  <i>or</i>      tropisms ;      ref to cell elongation ;      shoot and/or root grows in advantageous direction ;  <i>or</i>      ref to fruit drop / abscission ;      high concentration prevents / low concentration promotes ;</p> <p>gibberellin / gibberellic acid / GA ;      germination of seeds ; <b>A</b> embryo growth <b>R</b> 'seed grows'      stimulates release of, enzymes / named enzyme (from aleurone layer to endosperm) ;  <i>or</i>  <u>stem / internode</u>, elongation ;      plant reaches normal height / AW ;</p> <p><b>A</b> ethene / cytokinins as examples with appropriate roles</p> <p><b>A</b> applications of exogenous compounds e.g. weed killers, rooting compounds</p>	<b>max 6</b>

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
2 (a)	more, chloroplasts / chlorophyll ; large surface area (of chloroplasts) ; to absorb more of the light / AW ; to maximise (rate of) photosynthesis ;	max 2
(b)	<i>do not credit references to number of, or layers of, palisade cells assume answer is about shade leaves unless told otherwise</i>  thinner (leaf) / fewer cells ; thinner cuticle ; shorter / smaller, palisade <u>cells</u> ; more / larger, air spaces ; <b>R</b> gaps fewer chloroplasts in palisade (cells) ; fewer chloroplasts in spongy mesophyll (cells) ; more, stomata / guard cells ; less, vascular tissue / veins ; AVP ; e.g. correct ref to ratio between palisade and spongy tissue ref to staining	max 2
(c)	1 closely packed to absorb more of incident light / idea ; 2 columnar shape / arranged at right angles to surface of leaf, to reduce number of light absorbing cross walls ; 3 large vacuole pushes chloroplasts to edge of cell ; 4 chloroplasts on periphery of cell, short (diffusion) path for carbon dioxide ; 5 chloroplasts on periphery of cell to absorb light ; 6 large number of chloroplasts / much chlorophyll, to absorb light ; 7 chloroplasts can move within cells to absorb as much light as possible ; 8 chloroplasts can move to prevent damage (in high light intensity) ; 9 cylindrical cells resulting in air spaces ; 10 air spaces (between cells) to allow circulation of gases ; 11 large surface area for, gas exchange / diffusion ; 12 cell <u>walls</u> are thin, so short diffusion pathway / (greater) light penetration ; 13 air spaces act as reservoir of carbon dioxide ; 14 AVP ; 15 AVP ; e.g. non pigmented vacuole to allow light penetration ref to any chloroplast adaptation qualified	
	<b>R</b> cells found near top of leaf	max 7
	<b>QWC – legible text with accurate spelling, punctuation and grammar ;</b>	1

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
3 (a)	<i>mark each cross separately - 4 marks for each</i> <i>in each cross - parental genotypes and gametes – 1 mark</i> <i>F<sub>1</sub> genotypes and correctly matching phenotypes – 1 mark</i> <i>F<sub>2</sub> genotypes and correctly matching phenotypes – 1 mark</i> <i>correct ratio matching F<sub>2</sub> phenotypes – 1 mark</i>	
parental genotypes	- X <sup>R</sup> X <sup>R</sup> x X <sup>r</sup> Y	X <sup>r</sup> X <sup>r</sup> x X <sup>R</sup> Y
gametes	- X <sup>R</sup> (X <sup>R</sup> ) X <sup>r</sup> Y ; X <sup>r</sup> (X <sup>r</sup> ) X <sup>R</sup> Y ;	
F <sub>1</sub> genotypes	- X <sup>R</sup> X <sup>r</sup> (X <sup>R</sup> X <sup>r</sup> ) X <sup>R</sup> Y (X <sup>R</sup> Y)	(X <sup>R</sup> X <sup>r</sup> ) X <sup>R</sup> X <sup>r</sup> (X <sup>r</sup> Y) X <sup>r</sup> Y
F <sub>1</sub> phenotypes	- red female and red males ; red females and white males ;	
(gametes	- X <sup>R</sup> X <sup>r</sup> X <sup>R</sup> Y X <sup>r</sup> Y )	
F <sub>2</sub> genotypes	- X <sup>R</sup> X <sup>R</sup> X <sup>R</sup> X <sup>r</sup> X <sup>R</sup> Y X <sup>r</sup> Y X <sup>r</sup> X <sup>r</sup> X <sup>R</sup> Y X <sup>r</sup> Y	
F <sub>2</sub> phenotypes	- red eyed female (x 2) red eyed male white eyed male ; white eyed female red eyed female red eyed male white eyed male ;	
ratio	- 2: 1: 1 ; 1: 1: 1: 1 ;	
	<i>accept heterozygous female in cross 1, but must select correct two flies from F<sub>1</sub> phenotypes</i>	
	<i>accept X<sup>w</sup> as an alternative for white allele and penalise once if no key given</i>	
	<i>if r allele shown on Y chromosome penalise once</i>	<b>8</b>

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(b) *one mark for suitable example of disease caused by mutation or a type of mutation*

e.g. sickle cell anaemia, phenylketonuria, haemophilia, Down's syndrome, cystic fibrosis, cancer, base substitution, base addition, base deletion, non disjunction ;

*three marks for description of phenotype*

*sickle cell anaemia*

change in haemoglobin ;  
beta chain ;  
glutamic acid changed to valine ;

haemoglobin less soluble ;  
tend to stick together ;  
form long fibres ;  
red cells become, sickle shaped / distorted ;  
block small capillaries ;  
less oxygen, carried / delivered to tissues ;  
lethargy / tiredness ; R 'weak' on own  
painful crisis / 'sickling' ;  
resistance to malaria ;

*PKU*

no phenylalanine hydroxylase ;  
unable to form melanin ; A dark  
pigment  
lighter skin ;  
fairer hair ;  
phenylalanine accumulates ;  
brain damage in infants ;  
mentally retarded ;

*cancer*

uncontrolled cell division ;  
tumour ;  
metastasis ;  
damage to healthy tissues /  
specific example ;

*haemophilia*

no factor VIII ;  
blood slow to clot ;  
slow persistent bleeding ;

*Down's syndrome*

broad flat face ;  
learning difficulties ;  
increased risk of infections ;

*cystic fibrosis*

thick mucus in lungs ;  
small size ;  
poor digestion ;

A other examples with suitable phenotypic features

**max 4**

**[Total: 12]**

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- 4 (a) between different species ; 1
- (b) there are other, prey species / food ; 1
- (c) feed at different depths ;  
 feed on, different species / named species ;  
 ref to figures from table ;  
 little overlap in niches ;  
 relate to different size of, beaks / necks / birds ;
- max 4
- (d) nesting sites / territories / other foods / nesting materials ;  
*if list of resources mark first only* 1

[Total: 7]

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
5 (a)	mutations occur randomly ; variation in population ; humans ; select plants ; higher yielding / larger ears / desirable characteristics / AW ; cross plants with ideal features ; take seeds from these plants ; grow them ; repeat over many generations ; increase of allele frequency for desired characteristics ;	max 5
(b)	7,14, 21 ; <i>all correct for one mark</i>	1
(c)	<i>hybrids</i> parents have different, genotypes / chromosomes / named sets i.e. AB or ABD ; chromosomes of hybrid are, non homologous / AW ; <b>A</b> ora for emmer wheat <b>Q</b> , has odd number / 3 sets, of chromosomes ; <b>A</b> 3 n <b>R</b> 3 chromosomes chromosomes unable to, pair up / form bivalent / AW ; <b>A</b> ora for emmer wheat meiosis unable to take place ; <b>A</b> ora for emmer wheat no gametes produced ; <b>A</b> ora for emmer wheat	
	<i>emmer wheat</i> each chromosome has made a copy of itself / ref to non disjunction ;	max 3
(d)	have different chromosome numbers ; unable to form fertile offspring ; different, genes / genomes ; different <u>morphological (structural), physiological and biochemical</u> features ; reproductively isolated ;	max 3
(e)	eutrophication ; fertilisers, in run off / leached, into streams ; algal bloom / growth of surface weeds ; shading causes death of plants ; growth of, bacterial / microbe, population ; bacteria use up oxygen / increased BOD / less oxygen from photosynthesis ; (growth of aerobic bacteria = 2 marks) low oxygen levels kills many (animal) species ; <b>R</b> all species / (all) aquatic life anaerobic bacteria produce toxic hydrogen sulphide ;	max 4

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
<b>6 (a) (i)</b>	award two marks if correct answer (180 000) is given award one mark for calculation – if answer incorrect  125 x 60 x 24 ; 180 000 ;	<b>2</b>
<b>(ii)</b>	award two marks if correct answer (99-99.2) is given award one mark for calculation – if answer incorrect ecf applies if uses incorrect answer from (a)(i)  180 000 – 1500 ÷ 180 000 x 100 ; 99 – 99.2 ;	<b>2</b>
<b>(b) (i)</b>	too large / greater RMM than 68 000 – 70000 / unable to pass through <u>basement membrane</u> ;	<b>1</b>
<b>(ii)</b>	reabsorbed ; in, proximal convoluted tubule / pct ;	<b>2</b>
<b>(iii)</b>	water is reabsorbed (from filtrate) ; (approximately half) urea remains in urine ; <i>must be linked to first marking point</i> R all urea ref to reabsorption of other substances ;	<b>max 2</b>
<b>(iv)</b>	uric acid ; creatinine ; ammonium ions / ammonia ; hormones / named hormone ; AVP ; e.g. bile pigments      R creatine	<b>max 2</b>

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(c)

- 1 osmoreceptors in hypothalamus ;
- 2 (hypothalamus) detects low water potential of blood / AW ;
- 3 (production) ADH ;
- 4 by hypothalamus ;
- 5 (ADH passes to and from) posterior pituitary ;
- 6 released / transported, into blood ;
- 7 acts on collecting ducts (of kidney) ;
- 8 binds to receptor (in plasma membrane of collecting duct cells) ;
- 9 activates (phosphorylase) enzyme ;
- 10 causes vesicles with, water permeable channels / aquaporins ;
- 11 to bind with plasma membrane ;
- 12 increased permeability to water ;
- 13 water reabsorbed by osmosis ;
- 14 stimulation of thirst centre of brain / feel thirsty ;
- 15 water potential of blood rises switching off ADH release ;
- 16 AVP ; e.g. ref to phosphorylase enzyme  
 ref to neurosecretory cells  
 ref to nerve impulses passing from hypothalamus to pituitary

**max 7**

**QWC – clear well organised using specialist terms ;**

**1**

*award the QWC mark if four of the following are used in correct context*

osmoreceptors	hypothalamus
pituitary gland	collecting duct
vesicles	phosphorylase
aquaporins	neurosecretion

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
7 (a) (i)	<u>adenine</u> ;	
(ii)	<u>ribose</u> ;	2
(b)	x      x ; ✓      x ; x      ✓ ;	3
(c) (i)	chloroplast ;	1
(ii)	use of electron transport system / electron carriers / cytochromes ; release of energy ; R produce / create, energy moves / pumps, protons / H <sup>+</sup> ; R H or hydrogen across (energy transducing) membrane ; proton gradient / proton motive force / pH gradient ; ATP synthase / ATP synthetase / chemiosmotic channels ; A ATPase formation of ATP ; chemiosmosis ;	max 5
(d)	sodium and potassium pump ; potassium ions in and sodium ions out ; 3 sodium ions for 2 potassium ions ; helps to, maintain / restore, resting potential ; synthesis of acetylcholine ; from choline and ethanoic acid ; recycling, of neurotransmitter ; synthesis of acetylcholine receptors ; movement of vesicles ; ref to active transport of calcium out of neurone ;	max 4

[Total: 15]